

## Just-In-Time Inventory, Resource Planning, and Related Concepts Notes

### Introduction

This document provides comprehensive notes on **Just-In-Time (JIT) Inventory Management**, **Materials Requirements Planning (MRP)**, **Enterprise Resource Planning (ERP)**, **Theory of Constraints (TOC)**, **Capacity Management**, **Value Chain Analysis**, and **Business Process Reengineering**, as relevant to the CMA (US) curriculum. These topics focus on optimizing inventory, production, and business processes to enhance efficiency and profitability. The notes correct formatting errors, improve clarity, and include an example problem integrating business combinations with TOC and JIT.

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### Just-In-Time (JIT) Inventory Management

#### Overview

**Just-In-Time (JIT)** is a manufacturing philosophy that integrates purchasing, production, and inventory control to minimize inventory levels, reduce carrying costs, and meet customer demand efficiently.

#### Goals of JIT

- Meet customer demand in a timely manner with high-quality products.
- Minimize inventory to reduce storage costs and waste.
- Streamline production to enhance efficiency and flexibility.

#### Implementing JIT

- **Factory Reorganization:** Adopt lean production with manufacturing cells, where workers are cross-trained to operate multiple machines and perform supporting tasks, reducing downtime from breakdowns or absences.
- **Supplier Relationships:** Establish strong partnerships for frequent, small-batch deliveries of high-quality materials to avoid stockouts and defective units.
- **Kanban System:** A visual inventory control system using cards or tickets to signal when components are needed, eliminating excess storage in production areas.

**Example:** A car manufacturer uses Kanban to signal tire suppliers to deliver components only when assembly requires them, reducing warehouse inventory and ensuring fresh stock.

#### Benefits

- Lower inventory carrying costs.
- Reduced waste and improved quality.
- Faster response to customer demand.

#### Challenges

- Requires reliable suppliers and precise demand forecasting.
  - Vulnerable to supply chain disruptions due to low inventory buffers.
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### Materials Requirements Planning (MRP)

#### Overview

**Materials Requirements Planning (MRP)** is a computer-based system for managing dependent demand inventories in manufacturing. It ensures materials are available when and where needed based on demand forecasts.

#### Characteristics

- **Push System:** Produces goods for inventory based on forecasted demand, unlike JIT's pull system.
- **Key Inputs:**
  1. Demand forecasts for finished goods.
  2. Bill of materials (BOM) detailing components needed.
  3. Inventory status and lead times.
- **Outputs:** Purchase orders, production schedules, and inventory replenishment plans.

#### MRP II (Manufacturing Resource Planning)

- Extends MRP to integrate production planning, scheduling, capacity planning, job costing, financial management, shop floor control, and performance measurement.
- Provides a holistic view of manufacturing operations.

**Example:** A furniture manufacturer uses MRP to schedule wood and fabric orders based on forecasted demand for 1,000 tables, ensuring materials arrive just before assembly.

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### Enterprise Resource Planning (ERP)

#### Overview

**Enterprise Resource Planning (ERP)** systems integrate all business functions—production, sales, marketing, customer service, accounting, and more—to track resources and commitments.

#### Benefits

- Reduces operational costs through streamlined processes.
- Enhances inventory management with real-time data.
- Improves decision-making with integrated information.

**Example:** An electronics company uses an ERP system to coordinate production schedules with sales forecasts, reducing excess inventory and improving order fulfillment.

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## Theory of Constraints (TOC)

### Overview

**Theory of Constraints (TOC)** focuses on identifying and managing the bottleneck (constraint) that limits overall system performance to maximize profitability.

### Key Terms

- **Throughput:** Units produced and shipped to customers.
- **Throughput Time:** Time from receiving a customer order to shipment.
- **Throughput Contribution Margin:** Sales revenue minus direct materials cost (super-variable costs).
  - Formula:  $(\text{Selling Price} - \text{Direct Materials Cost}) \times \text{Units Produced}$ .
- **Inventory Costs:** Strictly variable costs (typically direct materials).
- **Operating Costs:** All costs except direct materials incurred to earn throughput.

### Steps in Managing Constraints

1. **Identify the Constraint:** Pinpoint the bottleneck (e.g., slowest machine).
2. **Exploit the Constraint:** Maximize its efficiency by prioritizing high-margin products and minimizing idle time.
3. **Subordinate Other Processes:** Align non-constraint processes to support the bottleneck.
4. **Elevate the Constraint:** Increase capacity (e.g., add resources or improve processes).
5. **Repeat:** Continuously identify and address new constraints.

### Drum-Buffer-Rope (DBR) System

- **Drum:** The bottleneck, setting the pace for production.
- **Buffer:** Minimal work-in-process inventory before the bottleneck to prevent delays.
- **Rope:** A scheduling mechanism to limit work-in-process and prevent overproduction.

### Example (Jacket Manufacturer):

- **Data:**
  - Winter Jacket: \$125 selling price, \$75 materials, 30 minutes hemming, 6,000 units demanded.

- Spring Jacket: \$75 selling price, \$30 materials, 25 minutes hemming, 8,000 units demanded.
- Hemming Capacity: 4,543 hours (272,580 minutes).

- **Throughput Contribution Margin:**

- Winter:  $\$125 - \$75 = \$50$ ;  $\$50 / 30 = \$1.67/\text{minute}$ .
- Spring:  $\$75 - \$30 = \$45$ ;  $\$45 / 25 = \$1.80/\text{minute}$ .

- **Decision:** Produce 8,000 spring jackets (200,000 minutes) first, then 2,524 winter jackets (75,720 minutes) to maximize throughput  $(\$45 \times 8,000 + \$50 \times 2,524 = \$486,200)$ .
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## Capacity Level and Management Decisions

### Plant Production Capacity

Capacity levels, or **denominator levels**, are used for cost allocation, pricing, and performance evaluation:

1. **Theoretical Capacity:** Maximum output with no downtime (unrealistic).
2. **Practical Capacity:** Theoretical capacity adjusted for downtime, best for pricing.
3. **Normal Capacity:** Average output over 2–3 years, used for external reporting.
4. **Expected Actual Capacity:** Forecasted output for the period.

### Choosing Capacity Level

- **Practical Capacity:** Preferred for pricing and bidding to exclude unused capacity costs.
- **Example:** Fixed costs of \$1,125,000 for 15,000 units yield \$75/unit at practical capacity. Pricing based on this ensures cost recovery without overpricing due to unused capacity.

### Under/Over-Applied Overhead

- **Under-Applied:** Occurs when actual production is lower than expected, resulting in less overhead applied than incurred.
- **Over-Applied:** Occurs when actual production exceeds expectations.
- **Closing Variances:**
  - Prorate among work-in-process, finished goods, and cost of goods sold (material).
  - Close to cost of goods sold (immaterial).

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## Value Chain Analysis

### Overview

The **value chain** encompasses all activities that transform inputs into outputs valued by customers, from design to delivery.

### Primary Activities

- Inbound Logistics: Receiving and storing materials.
- Operations: Manufacturing or service delivery.
- Outbound Logistics: Distributing finished products.
- Marketing and Sales: Promoting and selling products.
- Customer Service: Post-sale support.

### Support Activities

- Infrastructure: Facilities and management systems.
- Human Resources: Employee recruitment and training.
- Technology Development: R&D and process improvements.
- Procurement: Sourcing materials.

## Value Chain Analysis

- **Steps:**
  1. Identify value-adding activities.
  2. Assess their efficiency and cost-effectiveness.
  3. Optimize or eliminate non-value-adding activities.
- **Measure: Manufacturing Cycle Efficiency (MCE)** = Value-Added Time / Total Cycle Time.
- **Benefits:** Enhances competitive advantage by focusing on customer value.

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## Business Process Reengineering (BPR)

### Overview

**Business Process Reengineering (BPR)** involves radically redesigning processes to achieve significant improvements in performance, cost, quality, and speed.

### Priority for Reengineering

- **High-Impact Processes:** Those with significant customer impact.
- **Inefficient Processes:** High-cost or time-consuming processes.
- **Strategic Processes:** Critical to competitive advantage.

### Process

- Start with customer needs to redesign processes from scratch.
- Involves a reengineering leader and cross-functional teams.

### Quality and Internal Controls

- Post-reengineering, quality management ensures continuous improvement.
- Internal controls maintain process integrity.

### Benchmarking

- **Steps:**
  1. Identify processes to benchmark.
  2. Compare with industry best practices.
  3. Implement improvements.
- **Benefits:** Establishes standards for continuous improvement.

### Kaizen

- A Japanese philosophy of continuous, incremental improvement integrated with lean and JIT principles.

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## Example Problem: Business Combination with JIT and TOC

**Scenario:** A parent company acquires a subsidiary manufacturing two products (A and B) using JIT and TOC. The bottleneck is an assembly machine with 5,000 hours capacity. Post-acquisition, fixed costs increase by 10% due to fair value adjustments. Determine the optimal product mix and allocate fixed costs.

### Data:

- Product A: \$100 selling price, \$60 materials, 20 minutes/unit, 12,000 units demanded.
- Product B: \$80 selling price, \$40 materials, 15 minutes/unit, 15,000 units demanded.
- Fixed Costs: \$300,000 (pre-acquisition), now \$330,000.
- Capacity: 5,000 hours (300,000 minutes).

### Solution:

1. **Throughput Contribution Margin:**

- A:  $\$100 - \$60 = \$40$ ;  $\$40 / 20 = \$2.00/\text{minute}$ .
- B:  $\$80 - \$40 = \$40$ ;  $\$40 / 15 = \$2.67/\text{minute}$ .

2. **Optimal Mix:**

- Prioritize B (higher throughput per minute).
- B:  $15,000 \times 15 = 225,000$  minutes.
- Remaining:  $300,000 - 225,000 = 75,000$  minutes.
- A:  $75,000 / 20 = 3,750$  units.
- Total Throughput:  $(\$40 \times 15,000) + (\$40 \times 3,750) = \$750,000$ .

3. **Fixed Cost Allocation (Practical Capacity):**

- Total Units:  $15,000 + 3,750 = 18,750$ .
- Rate:  $\$330,000 / 18,750 = \$17.60/\text{unit}$ .
- A:  $3,750 \times \$17.60 = \$66,000$ .
- B:  $15,000 \times \$17.60 = \$264,000$ .

4. **JIT Impact:** The subsidiary's JIT system ensures minimal inventory, reducing carrying costs but requiring precise supplier coordination post-acquisition.

- **Business Combinations:** Require standardized JIT, TOC, and cost allocation methods, with adjustments for fair value in consolidated reporting.

**Analysis:** In a business combination, the parent must align JIT and TOC practices across subsidiaries, adjusting for fair value impacts to ensure consistent cost allocation and reporting.

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**Summary**

- **JIT Inventory:** Minimizes inventory through lean production, Kanban, and strong supplier relationships.
- **MRP and ERP:** MRP manages dependent demand inventories; ERP integrates all business functions for efficiency.
- **Theory of Constraints:** Maximizes profitability by managing bottlenecks using the DBR system.
- **Capacity Management:** Uses practical capacity for pricing to exclude unused capacity costs.
- **Value Chain Analysis:** Optimizes activities that add customer value.
- **Business Process Reengineering:** Redesigns processes for significant improvements, supported by Kaizen and benchmarking.